A Catalog and Atlas of Cataclysmic Variables: The Final Edition

Ronald A. Downes (1), Ronald F. Webbink (2), Michael M. Shara (3),
Hans Ritter (4), Ulrich Kolb (5), and Hilmar W. Duerbeck (6)

(1) Space Telescope Science Institute, 3700 San Martin Drive, Baltimore, MD 21218, USA

(2) Department of Astronomy, University of Illinois, 103 Astronomy Building,

1002 West Green Street, Urbana, IL 61801

(3) American Museum of Natural History, Astrophysics Department,

Central Park West and 79th Street, New York, NY 10024

(4) Max-Planck-Institut für Astrophysik,

Karl-Schwarzschild-Sterne 1, D-85741 Garching, Germany

(5) Department of Physics and Astronomy, The Open University,

Walton Hall, Milton Keynes MK7 6AA, UK

(6) WE/OBSS, Free University (VUB), Pleinlaan 2, B-1050 Brussels,

Belgium

Abstract

The Catalog and Atlas of Cataclysmic Variables has been a staple of the CV community for over 10 years. The catalog has grown from 751 CVs in 1993 to 1600 CVs at present. The catalog became a "living" edition in 2001, and its contents have been continually updated since that time. Effective 27 January 2006, the catalog will transition to an archival site, with no further updates to its contents. While it is antipicated that the site will remain active, we present the complete contents of the site as a precaution against a loss of the on-line data.

1   Introduction

The Catalog and Atlas of Cataclysmic Variables (Edition 1: Downes and Shara 1993; Edition 2: Downes, Webbink, and Shara 1997; Living Edition: Downes et al. 2001) has been a prime source of information for the cataclysmic variable (CV) community for over 10 years. The catalog has also grown substantially over time, from 751 CVs in the first edition, to 865 CVs in the second edition, to 1600 CVs at present. Over time, it has evolved from a paper document to a "living" document, which allowed for rapid updates to its content.

arXiv:astro-ph/0602278v1 13 Feb 2006

Due to the retirement of the lead author, the on-line catalog will transition from an active site to an archival site effective 27 January 2006, with no further updates to its content. This paper provides the final content of the catalog and atlas, although it is planned for the site to remain accessible for the forseeable future.

Section 2 describes the catalog, while Section 3 describes the Atlas. Section 4 summarizes the state of the catalog.

2 The Catalog

The catalog was frozen on 27 January 2006, and the final statistics are given in Table 1. Due to the size of the catalog, several files are needed to supply all the information, and these files listed in Table 2.

The fields in the catalog are:

GCVS NAME - the name of the object in the General Catalogue of Variable Stars and subsequent Namelists. For those objects without variable star designations, we list the constellation name only (which were derived from Roman (1987)). Since some constellations contain more than one object without a GCVS designation, in previous versions we included a number (a strictly provisional designation) after the constellation name. In the on-line version of the catalog, such ad hoc numbering was no longer required. However, for ease of comparison with previous versions, we have retained this type of designation for all objects that had it.

COORDINATES - whenever possible, the J2000 coordinates of the objects as measured in the International Celestial Reference System (ICRS), or taken from the literature (see Coordinate Reference). The right ascension is given to the nearest 0.01s, while the declination is given to the nearest 0.1s; for objects that are very faint or not visible, the coordinates are given to a lesser accuracy. For faint novae, the coordinates are taken from Duerbeck (1987) or from the literature (for recent novae), and are precessed to the J2000 equinox. For those objects without available/usable finding charts, coordinates have been obtained from the literature, and are generally given to a lesser accuracy than those objects measured in this work.

PROPER MOTION - the proper motion for the object in arcseconds/yr (RA and Dec), along with the associate errors. The epoch for the coordinates is also given. Users should consult the Proper Motion Reference for the definition of the corresponding reference frame.

GALACTIC COORDINATES - the galactic longitude (l) and latitude (b).

TYPE - the type of variability of the object. Table 3 lists the various types used in this work, which is based on the classification scheme used in the GCVS. Those types in upper-case letters are taken directly from the GCVS, while those in lower-case letters have been obtained from the literature; these are generally in agreement with the GCVS and are presumably more reliable. Whenever possible, a type from the literature was used. There are many objects in the catalog designated NON-CV, which are stars that have been previously cataloged as CVs, and are included for completeness; the references for these stars are those papers which refute the CV nature of the objects. The revised classification is given in the notes for each object.

PERIOD - the orbital period (in days) for the object.

YEAR OF OUTBURST - the year of outburst (for novae).

CLUSTER SOURCE - a flag indicating if the object is in a globular (G) or open (O) cluster.

MAGNITUDE RANGE - the MAXimum and MINimum magnitudes for the objects; the magnitude systems are listed in the Table 4. For novae, the primary sources are Duerbeck

(1987) and Duerbeck (2001, unpublished), while for the non-novae, the catalog of Ritter and Kolb (1998 and later updates) is the prime source. When no other references to brightness were available, the GCVS values are used.

COORDINATE REFERENCE - a code for a reference to the coordinates. Entries listed as ICRS (International Celestial Reference System) have been measured by the authors in that reference frame; other codes refer to references from the literature (see the References.html file for the code definitions). An asterisk (*) following the reference means that there is a comment regarding the coordinate measurement (see the ASCII Notes Report for the object).

PROPER MOTION REFERENCE - a code for a reference to the proper motion (see the References.html file for the code definitions).

TYPE REFERENCE - a code for a reference to the CV classification (see the References.html file for the code definitions). An asterisk (*) following the reference means that there is a comment regarding the classification (see the ASCII Notes Report for the object).

CHART REFERENCE - a code for the original reference from which our chart is based (see the References.html file for the code definitions). Note that the identifications of the CVs are based on the published charts (or in some cases coordinates only), and have not been independently verified by the authors. An asterisk (*) following the references means that there is a comment regarding the identification (see the ASCII Notes Report for the object).

SPECTRUM REFERENCE - a code for a reference to a published spectrum (see the References.html file for the code definitions). A suffix S indicates a spectrum in quiescence, while a suffix of X indicates a spectrum in outburst. Whenever available, the quiescent spectrum was chosen for the catalog over an outburst spectrum. A colon (:) following the reference indicates that the spectrum is only described, the spectrum is a glass plate tracing, or the reference is unconfirmed (for only a few novae in Duerbeck's atlas). An asterisk (*) following the references means that there is a comment regarding the spectrum (see the ASCII Notes Report for the object).

PERIOD REFERENCE - a code for a reference to the period (see the References.html file for the code definitions). Note that all periods come from the catalog of Ritter and Kolb (1998 and later updates), or from Ritter (private communication).

OTHER NAME - discovery or common alternative (non-GCVS) designation for the object.

SPACE-BASED OBSERVATIONS - a "Y" in the field means that data from that satellite exists; for HST data, the notes for the object indicate if the data are imaging, spectroscopy, photometry, and/or astrometric.

3   The Atlas

Finding charts for all objects with chart references (including objects which we have identified based on positional coincidence) are included (see the Finding Charts directory). Most charts are based on the Digitized Sky Survey, and since those plates vary in both color and limiting magnitude, we note (see the Finding Charts details file) the emulsion and exposure time for each chart. The field-of-view for the charts is also indicated (mostly 5' x 5'). First Generation DSS emulsion/filter combinations are defined in the Table 5, while the Second Generation DSS emulsion/filter combinations are defined in Table 6.

Some charts are ground-based CCD images, while others (mostly globular cluster CVs) are HST images; the filters and exposure times for these are given in the Finding Charts details file. North is up and East to the left for all charts unless explicitly noted (for some

HST images). Tick marks are used to identify the object, while circles are used for those fields where this is not a definitive identification. Note that for some extremely crowded fields, a circle has been used to mark the object.

4   Summary

The Catalog and Atlas of Cataclysmic Variables "living" web site will transition to an archival site on 27 January 2006. Although the site should remain accessible after that date, we provide the complete contents of the catalog and atlas as a precaution against a loss of the archival data.

Acknowledgments

References

Downes, R.A. and Shara, M.M. 1993, PASP, 105, 127

Downes, R.A., Webbink, R.F., and Shara, M.M. 1997, PASP, 109, 345

Downes, R.A., Webbink, R.F., Shara, M.M., Ritter, H., Kolb, U. and Duerbeck, H.W. 2001, PASP, 113, 764

Duerbeck, H.W. 1987, Space Sci. Rev., 45, 1

Ritter, H. and Kolb, U. 1998, A&AS, 129, 83

Roman, N.G. 1987, PASP, 99, 695

Steiner, J.E. and Diaz, M.P. 1998, PASP, 110, 276

Webbink, R.F., Livio, M., Truran, J.W., and Orio, M. 1987, ApJ, 314, 653

Table 1. CV Catalog Statistics

Object Type	Number of Objects
Number of Objects in the Catalog	1829
Number of CV's in the Catalog	1600
Number of non-CVs in the catalog	229
Number of Globular Cluster CVs in the catalog	158
Number of Open Cluster CVs in the catalog	6
Number of UG in the catalog	636 (40%)
Number of novae in the catalog	337 (21%)
Number of NL in the catalog	263 (16%)
Number of cvs in the catalog	342 (21%)
Number of ibwd in the catalog	17 (1%)
Number of cbss in the catalog	3 (0%)
Number of SNe in the catalog	1 (0%)
Number of cvs with no GCVS name	716 (45%)
Number of UGs with quiescent spectra	300 (47%)
Number of UGs with outburst spectra	37 (6%)
Number of UGs with no spectra	299 (47%)
Number of novae with quiescent spectra	77 (23%)
Number of novae with outburst spectra	148 (44%)
Number of novae with no spectra	112 (33%)
Number of novalikes with quiescent spectra	223 (85%)
Number of novalikes with no spectra	40 (15%)
Number of cvs with quiescent spectra	158 (46%)
Number of cvs with outburst spectra	5 (1%)
Number of cvs with no spectra	179 (52%)
Number of IBWDs with quiescent spectra	16 (94%)
Number of IBWDs with outburst spectra	1 (6%)
Number of CBSSs with quiescent spectra	2 (67%)
Number of CBSSs with no spectra	1 (33%)
Number of objects with quiescent spectra	776 (49%)
Number of objects with outburst spectra	191 (12%)
Number of objects with no spectra	632 (40%)
Number of objects with a known period	477 (30%)
Number of objects with a known period < 1 hour	14 (3%)
Number of objects with a known period between 1-2 hours	159 (33%)
Number of objects with a known period between 2-3 hours	52 (11%)
Number of objects with a known period between 3-4 hours	103 (22%)
Number of objects with a known period between 4-5 hours	50 (10%)
Number of objects with a known period between 5-6 hours	25 (5%)
Number of objects with a known period between 6-7 hours	20 (4%)
Number of objects with a known period between 7-8 hours	10 (2%)
Number of objects with a known period between 8-9 hours	9 (2%)
Number of objects with a known period > 9 hours	34 (7%)
Number of CVs with significant ($> 3\sigma$) proper motions	433
Number of objects with IUE data	192
Number of objects with HST data	289
Number of objects with Ariel 5 data	8
Number of objects with HEAO-1 data	42
Number of objects with HEAO-2 data	67
Number of objects with EXOSAT data	83
Number of objects with ROSAT data	297
Number of objects with Ginga data	20
Number of objects with ASCA data	61
Number of objects with EUVE data	35

Table 2. Files included in this publication

Name	Contents
References	a html file which defines all the reference codes
ASCII Report	a html file listing all the object data, sorted by right ascension
ASCII Report, comma separated	a text file (csv format) listing all the object data, sorted by right ascension
ASCII Notes Report	a html file list all the object notes, sorted by right ascension
Finding Chart details	a text file listing the information (image source, exposure time, and field size) for each chart
Finding Charts	a directory containing jpg images of the finding charts

Table 3. CV Classifications

Type	Definition
UG	U Gem variable (dwarf nova)
UGZ	U Gem variable (Z Cam subtype)
UGSS	U Gem variable (SS Cyg subtype)
UGSU	U Gem variable (SU UMa subtype)
UGWZ	U Gem variable (WZ Sge subtype)
N	nova
NA	fast nova
NB	slow nova
NC	very slow nova
NR	recurrent nova
NRA	recurrent nova - giant donor (Webbink et al. 1987)
NRB	recurrent nova - non-giant donor (Webbink et al. 1987)
SN	possible supernova with no galaxy visible
NL	novalike variable
NLV	novalike variable (V Sge subtype; Steiner and Diaz 1998)
UX	novalike variable (UX UMa subtype)
VY	novalike variable (VY Scl subtype - systems which undergo low states)
AM	AM Herculis variable (synchronous rotators)
DQ	DQ Herculis variable (non-synchronous rotators)
CV	cataclysmic variable (no type classification)
CBSS	close binary supersoft x-ray source
IBWD	interacting binary white dwarf
M	Mira variable
I	Irregular variable
UV	UV Ceti-type star
Z AND	symbiotic variable (Z And subtype)
NON-CV	not a cataclysmic variable (although once classified as such)
NON-EX	non-existent object
PEC	peculiar
:	uncertain
::	very uncertain

Table 4. Magnitude Systems

Magnitude Code	Definition
U	Johnson U
B	Johnson B
V	Johnson V
R	Johnson R
I	Johnson I
c	unfiltered CCD
f	m(2200Å)
g	Gunn g
h	HIPPARCOS magnitude system
i	Gunn i
j	SRC j (unfiltered IIIa-J)
p	photographic
r	red
s	Sloan g*
u	m(1400Å)
v	visual
w	m(3000Å)
x	m(F336W)

Table 5. First Generation DSS Emulsion Codes

Emulsion Code	Definition
POSSI-E	POSS-E RED PLATE
XV	SERC-V Equatorial extension
S	SERC-J Survey

Table 6. Second Generation DSS Emulsion Codes

Emulsion Code	Definition
UK-F	'Galactic Red' survey (UK Schmidt) IIIaF + RG610 SHORT exposure in galactic plane
POSSII-F	POSS-II Red IIIaF + RG610
POSSII-J	POSS-II Blue IIIaJ + GG385
ER	'Equatorial Red' survey (UK Schmidt) IIIaF + RG610
XS	'Second Epoch Southern' survey (UK Schmidt) IIIaF + RG610